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New distribution records for Sciomyzidae species (Insecta, Diptera) from Rio Grande do Sul, Brazil

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Abstract: An inventory of the species of Sciomyzidae that occur in the Coastal Plains of southern Brazil was conducted. Sampling resulted in 304 specimens, 278 of which were collected with nets and 26 with Malaise traps. A total of 11 species distributed in eight genera were collected. New distribution records for *Protodictya iguassu* Steyskal, 1950 and *Thecomyia lateralis* (Walker, 1858) are recorded from Rio Grande do Sul.

Key words: snail-killing fly, *Protodictya iguassu, Thecomyia lateralis,* Coastal Plain, Neotropical Region

Little is known about the Neotropical Sciomyzidae, a group of flies potentially useful in the biological control of mollusks. A total of 85 species in 23 genera occur in the region (Berg and Knutson 1978; Ferrar 1987; Knutson 1987; Marinoni and Mathis 2000). Worldwide, the family includes 600 species in 50 genera (Marinoni and Knutson 1992; Vala *et al.* 1999; Marinoni *et al.* 2003). Most described species are in the Nearctic and Palearctic regions, contrasting with many groups of flies that are more diverse in the Neotropics (Marinoni and Mathis 2000).

Sciomyzids are considered to be "true malacophages" and are classified into different behavioral groups. The biology of 203 species is known, and only three are not associated with mollusks (Knutson and Vala 2011). Sciomyzids that prey on non-operculated aquatic snails are promising in the control of species that act as intermediary hosts of diseases such as fascioliasis and schistosomiasis (Berg and Knutson 1978; Barker *et al.* 2004).

Among sciomyzids, *Pherbellia* Robineau-Desvoidy, with 95 species, and *Sepedon* Latreille, with 80 species, are the largest genera. Both occur worldwide. In the Neotropical region, *Protodictya* Malloch (8 species), *Sepedonea* Steyskal (13 species), *Sepedomerus* Steyskal (3 species) and *Thecomyia* Perty (12 species) are the most speciose (Marinoni and Carvalho 1993; Marinoni *et al.* 2003; Marinoni and Mathis 2006). They include predators of aquatic mollusks and belong to the tribe Tetanocerini. The predatory species in these three genera all belong to the same behavioral group — predators of non-operculate snails at or just below the water surface, just above surface on emergent vegetation, and occasionally those exposed on moist surfaces — as defined by Knutson and Vala (2011).

There are no apomorphic characters to facilitate the identification of sciomyzid adults. These can be differentiated from other acalyptrate dipterous by the following set of morphological characters: oral vibrissae absent; postvertical setae divergent to parallel; costal vein without breaks; subcostal vein complete, free from R_1; vein A_1 complete; some or all tibiae with preapical dorsal seta; body length between 2 and 13 mm and coloring of the body ranging within pale yellow-brown, gray and black. However, their monophyly is grounded in two larval characters: the malacophagous behavior of the larvae and the presence of a serrate ventral arch that articulates with the lower margin of the mouth hooks (Marinoni and Mathis 2000).

This study aims to contribute to the knowledge on the family Sciomyzidae, and to foster future studies on the taxonomy, ecology and behavior of the group in the Neotropical region, as well as the use of sciomizyds for the biological control of mollusks. With that goal in mind, we set out to make an inventory of the species that occur in the Coastal Plains of the state of Rio Grande do Sul, Brazil.

The coastal plain of Rio Grande do Sul (PCRS) is formed by the strip around the coastal lagoons Lagoa dos Patos and Lagoa Mirim-Mangueira, and the northern littoral of Rio Grande do Sul. A total of 29 collecting sites in eight municipalities and 12 localities were sampled, as shown in Table 1 and Figure 1. Eleven sites were within unprotected areas and the remaining sites were within parks, reserves, or ecological stations, namely: Taim Ecological Station (Taim E. S.), Lagoa do Peixe National Park (Lagoa do Peixe N. P.), José Lutzenberger State Park (Guarita Park), and Lami Biological Reserve (ReBio Lami).

Authorization for collecting in the protected areas was issued by the organizations responsible for maintaining each area (SISBIO authorization # 30404).

The collecting sites were selected among priority sites for the conservation of invertebrates, as defined by the Ministério do Meio Ambiente (MMA 2000).

Sampling took place between October 2011 and February 2012, in the mornings from 9:00 to 10:00. For collecting, entomological nets were used to beat the vegetation in or

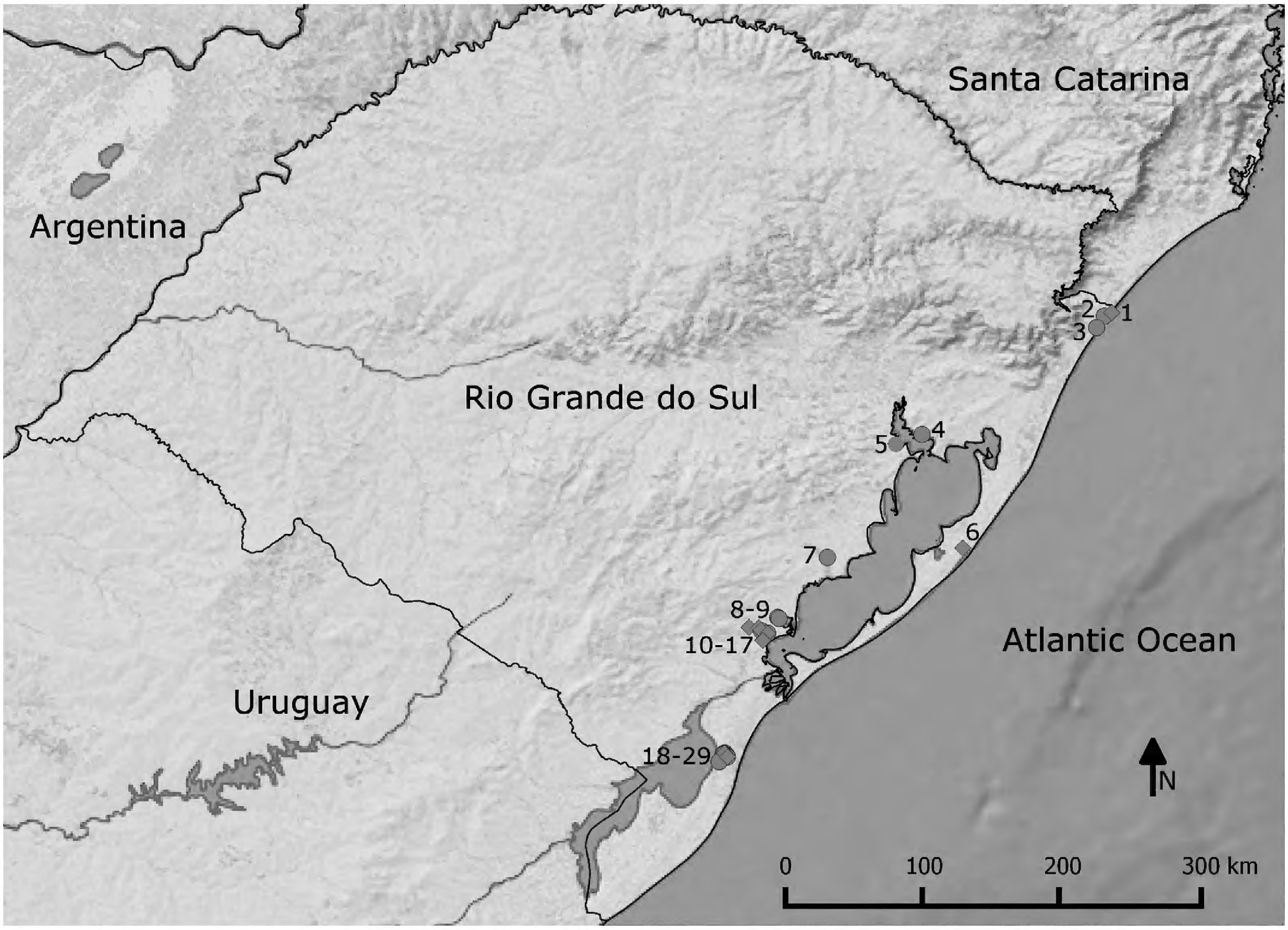

Figure 1. Map of Rio Grande do Sul with points of collection; blue circle = collection sites, red diamond = collection sites with new records.

Table1. Points, equivalent to collecting sites with coordinates and collectors.

Point	Municipalities	Locality	Latitude	Longitude	Collectors
1	Torres	Guarita Park	29°21′21″ S	49°44′08″ W	Â. Z. Silva, F. D. Kirst, R. F. Krüger
2	Torres	Itapeva lagoon	29°22′49″ S	49°47′19″ W	Â. Z. Silva, F. D. Kirst, R. F. Krüger
3	Arroio do Sal	RS-389 highway	29°27′50″ S	49°50′41″ W	Â. Z. Silva, F. D. Kirst, R. F. Krüger
4	Porto Alegre	ReBio Lami	30°14′11″ S	51°06′20″ W	F. D. Kirst, R. F. Krüger
5	Barra do Ribeiro	Guaíba Lake	30°18′15″ S	51°17′37″ W	F. D. Kirst, R. F. Krüger
6	Tavares	Lagoa do Peixe N. P.	31°03′20″ S	50°48′39″ W	F. D. Kirst, R. F. Krüger
7	Camaquã	Pacheca village	31°07′23″ S	51°47′13″ W	F. D. Kirst, R. F. Krüger
8	Pelotas	Corrientes district	31°33′24″ S	52°08′44″ W	F. D. Kirst, R. F. Krüger
9	Pelotas	Corrientes district	31°33′51″ S	52°08′11″ W	F. D. Kirst, R. F. Krüger
10	Pelotas	Arroio Pelotas river	31°37′40″ S	52°21′10″ W	F. D. Kirst, R. F. Krüger
11	Pelotas	Arroio Pelotas river	31°37′53″ S	52°16′59″ W	F. D. Kirst, R. F. Krüger
12	Pelotas	Arroio Pelotas river	31°38′54″ S	52°16′02″ W	F. D. Kirst, R. F. Krüger
13	Pelotas	Arroio Pelotas river	31°39′05″ S	52°15′50″ W	F. D. Kirst, R. F. Krüger
14	Pelotas	Cotovelo road	31°40′12″ S	52°13′06″ W	F. D. Kirst, R. F. Krüger
15	Pelotas	Cotovelo road	31°40′20″ S	52°13′01″ W	F. D. Kirst, R. F. Krüger
16	Pelotas	Arroio Pelotas river	31°43′18″ S	52°15′15″ W	F. D. Kirst, R. F. Krüger
17	Pelotas	Arroio Pelotas river	31°43′21″ S	52°15′13″ W	F. D. Kirst, R. F. Krüger
18	Rio Grande	Taim E. S.	32°32′04″ S	52°31′42″ W	Â. Z. Silva, F. D. Kirst, R. F. Krüger
19	Rio Grande	Taim E. S.	32°32′06″ S	52°31′45″ W	Â. Z. Silva, F. D. Kirst, R. F. Krüger
20	Rio Grande	Taim E. S.	32°32′24″ S	52°32′14″ W	F. D. Kirst, S. K. Cunha
21	Rio Grande	Taim E. S.	32°32′29″ S	52°32′22″ W	Â. Z. Silva, F. D. Kirst, R. F. Krüger
22	Rio Grande	Taim E. S.	32°32′36″ S	52°31′58″ W	F. D. Kirst, S. K. Cunha
23	Rio Grande	Taim E. S.	32°33′02″ S	52°30′52″ W	Â. Z. Silva, F. D. Kirst, R. F. Krüger
24	Rio Grande	Taim E. S.	32°33′18″ S	52°31′04″ W	F. D. Kirst, S. K. Cunha
25	Rio Grande	Taim E. S.	32°33′22″ S	52°31′18″ W	F. D. Kirst, S. K. Cunha
26	Rio Grande	Taim E. S.	32°33′42″ S	52°30′35″ W	Â. Z. Silva, F. D. Kirst, R. F. Krüger
27	Rio Grande	Taim E. S.	32°33′45″ S	52°30′27″ W	Â. Z. Silva, F. D. Kirst, R. F. Krüger
28	Rio Grande	Taim E. S.	32°33′46″ S	52°30′35″ W	Â. Z. Silva, F. D. Kirst, R. F. Krüger
29	Rio Grande	Taim E. S.	32°35′49″ S	52°34′06″ W	Â. Z. Silva, F. D. Kirst, R. F. Krüger

around swamps. Additionally, Malaise traps (model as used by Townes 1972) with modifications in the collecting vial (see Townes 1972; Brown 2005; Duarte *et al.* 2010) were left in the field for 8 d.

Collecting vials and specimens collected with nets were taken to the Laboratory of Ecology of Parasites and Vectors of the Universidade Federal de Pelotas.

After sorting and preparation of the material, specimens of Sciomyzidae were identified in the laboratory with the aid of entomological keys and descriptions by Steyskal and Knutson (1975), Steyskal (1974), Freidberg *et al.* (1991), Marinoni and Knutson (1992), Marinoni *et al.* (2003), and Marinoni and Mathis (2006).

Voucher specimens are deposited in the entomological collection Padre Jesus Santiago Moure, Department of Zoology, Universidade Federal do Paraná. Specimens were databased in the Projeto *Taxonline*—Rede Paranaense de Coleções Biológicas (www.taxonline.ufpr.br).

A total of 304 sciomyzids were captured. Eight genera and 11 species were identified. Most specimens were captured with entomological net (*n*=278; Table 2) and the remaining with Malaise traps (*n*=26; Table 3). The following species were present: *Dictyodes dictyodes* (Wiedemann, 1830), *Perilimnia albifacies* Becker, 1919, *Protodictya guttularis* (Wiedemann, 1830), *Protodictya iguassu* Steyskal, 1950, *Protodictya lilloana* Steyskal, 1953, *Sepedomerus bipuncticeps* (Malloch, 1933), *Sepedonea giovana* Marinoni & Mathis, 2006, *Sepedonea trichotypa* Freidberg, Knutson & Abercrombie, 1991 and *Thecomyia lateralis* (Walker, 1858). Additionally, two morphospecies of *Pherbellia* Robineau-Desvoidy were identified. *Pherbellia* is classified in the Sciomyzini and the remaining species in the Tetanocerini (Marinoni and Mathis 2000).

Among the species collected, seven are classified in the same behavioral group by Knutson and Vala (2011). They are: *Dictyodes dictyodes*, *Sepedomerus bipuncticeps*, *Protodictya lilloana*, *P. guttularis*, *Sepedonea giovana* and *Sepedonea trichotypa*. According to the authors, these species are "predators of non-operculate snails at or just below the water surface, just above the surface on emergent vegetation, and occasionally those exposed on moist surfaces."

Our collecting areas are typical habitats of Sciomyzidae: marshes and wet meadows (Neff and Berg 1966). These areas are not disturbed and their substrate is not very modified. Areas with altered soil are not attractive to sciomyzids (Knutson and Vala 2011).

Adult sciomyzids are not attracted by flowers, and there is little information about which kinds of vegetation they prefer (Knutson and Vala 2011). Few specimens are collected

Table 2. List of species collected with entomological net by date of collection. Where: N = Number of specimens collected; Point= collecting locality referred to in Table 1.

Taxonomic units (TUs)	N	Date	Locality	Point
Dictyodes dictyodes	2	11.xii.2011	Taim E. S.	23
Perilimnia albifacies	3	06.xi.2011	Corrientes district	9
	2	30.xii.2011	Taim E. S.	20
Pherbellia sp. 1	1	29.xii.2011	Taim E. S.	24
Pherbellia sp. 2	1	02.xi.2011	Cotovelo road	14
	1	03.xi.2011	Arroio Pelotas river	13
	1	11.xii.2011	Taim E. S.	21
	1	29.xii.2011	Taim E. S.	24
Protodictya guttularis	4	02.xi.2011	Cotovelo road	14
	11	08.xi.2011	Corrientes district	9
	1	11.xii.2011	Taim E. S.	21
	23	12.xii.2011	Taim E. S.	18
	50	29.xii.2011	Taim E. S.	24
	4	29.xii.2011	Taim E. S.	25
	14	13.xii.2011	Taim E. S.	23
	60	30.xii.2011	Taim E. S.	20
	12	30.xii.2011	Taim E. S.	22
Protodictya lilloana	9	02.xi.2011	Cotovelo road	14
	1	08.xi.2011	Corrientes district	9
	1	12.xii.2011	Taim E. S.	18
	2	17.i.2012	Itapeva lagoon	2
Sepedomerus bipuncticeps	1	24.xi.2011	Guaíba lake	5
Sepedonea giovana	1	25.xi.2011	Pacheca village	7
	1	16.i.2011	RS-389 highway	3
Sepedonea trichotypa	1	02.xi.2011	Cotovelo road	14
	1	03.xi.2011	Arroio Pelotas river	13
	1	08.xi.2011	Corrientes district	9
	7	25.xi.2011	Pacheca village	7
	1	28.xi.2011	ReBio Lami	4
	1	11.xii.2011	Taim E. S.	21
	6	12.xii.2011	Taim E. S.	18
	30	29.xii.2011	Taim E. S.	24
	6	29.xii.2011	Taim E. S.	25
	9	13.xii.2011	Taim E. S.	23
	3	30.xii.2011	Taim E. S.	20
	1	30.xii.2011	Taim E. S.	22
	4	17.i.2012	Itapeva lagoon	2

Table 3. List of species collected with Malaise trap by date of collection; N = number of specimens collected; Point= collecting locality referred to in Table 1.

Taxonomic units (TUs)	N	Date	Locality	Point
Dictyodes dictyodes	1	09–16.xii.2011	Taim E. S.	26
	1	09–16.xii.2011	Taim E. S.	28
	1	09–16.xii.2011	Taim E. S.	27
Pherbellia sp. 2	2	28.x–05.xi.2011	Arroio Pelotas river	11
	1	09–16.xii.2011	Taim E. S.	29
Protodictya guttularis	3	27.x–04.xi.2011	Cotovelo road	16
	1	28.x–05.xi.2011	Corrientes district	8
Protodictya iguassu	1	27.x–04.xi.2011	Arroio Pelotas river	16
	2	27.x–04.xi.2011	Arroio Pelotas river	17
	1	27.x–04.xi.2011	Cotovelo road	15
	2	28.x–05.xi.2011	Arroio Pelotas river	10
	1	28.x–05.xi.2011	Arroio Pelotas river	11
	1	28.x–05.xi.2011	Arroio Pelotas river	12
	1	09–16.xii.2011	Taim E. S.	27
	1	09–16.xii.2011	Taim E. S.	19
	1	03–11.ii.2012	Lagoa do Peixe N. P.	6
Protodictya lilloana	1	27.x–04.xi.2011	Arroio Pelotas river	16
Thecomyia lateralis	4	14–22.i.2012	Guarita Park	1

by Malaise traps (Marinoni *et al.* 2004; Knutson and Carvalho 1989), making net sweeping the best collecting method for these flies. Most specimens are collected while sweeping the vegetation surrounding the water bodies inhabited by mollusks. The fact that sciomyzid adults are solitary and fly short distances may explain why they usually do not show up in Malaise.

Protodictya, in our samples, was represented by the greatest number of species (three). The most abundant was *P. guttularis*, with 179 individuals collected with nets and four with traps (n=183). One of the species collected using Malaise traps, *P. iguassu*, was not represented in net samples. The distribution of this species, formerly restricted to the Brazilian states of Paraná and Santa Catarina, is now extended to Rio Grande do Sul. *Protodictya iguassu* also occurs in Paraguay and Argentina (records for Misiones and Buenos Aires, respectively).

Protodictya is exclusively Neotropical and includes eight species (Marinoni and Knutson 1992). Abercrombie (1970) investigated the biology of *P. guttularis* and *P. lilloana* in the laboratory. According to him, "Larvae of *P. guttularis* are voracious feeders on aquatic snails and seem well adapted to life at the surface film with their long posterior lobes." Abercrombie (1970) collected specimens in almost all months of the year, except for November, indicating that *P. guttularis* is active year-round.

After *Protodictya guttularis*, the most abundant species was *Sepedonea trichotypa*. All individuals (n=71) were collected by net sweeping. *Sepedonea* is exclusively Neotropical, and currently includes 13 species. Abercrombie (1970) also studied the biology of the genus species.

Dictyodes, with two species distributed in the Neotropical region (Steyskal 1974), was represented in our samples by *D. dictyodes*, (n=5) which was captured with Malaise and net.

Sepedomerus bipuncticeps was collected in the municipality of Barra do Ribeiro, at the margins of the Guaíba Lake (n=1). This species was previously known from Panama to Argentina, including Brazil (Knutson *et al.* 1976). The other species of the genus are not recorded from Brazil. *Sepedomerus macropus* (Walker, 1849), is distributed from south of United States to Peru, while *Sepedomerus caeruleus* (Melander, 1920), is restricted to Caribbean islands.

Species of *Pherbellia* can be parasitoids or predators. The genus is distributed worldwide and the included species are classified in different behavioral groups by Knutson and Vala (2011). We collected two species, one with Malaise trap and one with a net.

In our survey, *Thecomyia lateralis* was present in Malaise traps set in Torres, northern littoral of Rio Grande do Sul. Most species of *Thecomyia* occur in Central America, and south of it up to the southern state of Santa Catarina. *Thecomyia lateralis* reaches the southernmost portion of Brazil, and after this work, its distribution has been extended to Rio Grande do Sul.

In the northern hemisphere the greatest diversity of Sciomyzidae is observed in temperate areas (Berg and Knutson 1978). So, in addition to these two new records for the Rio Grande do Sul, we believe that more species will be found with increased sampling effort.

In addition, these species are predators of non-operculate snails in freshwater, which is their developmental environment. Species of this group of mollusks can be vectors of diseases such as fasciolosis and schistossomiasis. A greater knowledge of the sciomyzid species and their habitats and biology is of great importance for their potential future use as controllers of vectors.

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